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09/509,472	04/21/2000	MASARU MITSUI	105875	9665

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EXAMINER	
THORNTON, YVETTE C	
ART UNIT	**PAPER NUMBER**
1752	23

DATE MAILED: 01/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application N .	Applicant(s)	
	09/509,472	MITSUI ET AL.	
	Examiner	Art Unit	
	Yvette C. Thornton	1752	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *31-70* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *31-34,41-43,47-57,60 and 63-70* is/are rejected.

7)☒ Claim(s) *35-40,44-46,58,59,61 and 62* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 May 2000* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This is written in reference to application number 09/509472 filed on May 19, 2000 and is a 371 of PCT/JP99/04124 filed on July 30, 1999.

Claim Status

1. Claims 31-70 are currently pending.

2. The amendment to claim 31 is sufficient to overcome the claim objection set forth in the previous office action.

Drawings

3. Figure 11 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). The examiner notes that figure 11 is discussed in the background of the invention (pg. 5, l. 5-21), and therefore not considered to inventive. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Response to Arguments

4. In response to above objection to the drawings, applicant argue that a label of "Prior Art" would be inappropriate due to the fact that the graph of Figure 11 is a result of applicants own experiments and investigations of the present invention. The examiner disagrees. A label of "Prior Art" is appropriate for *any* work done by anyone prior to what the applicant is claiming as inventive. In the Brief Description of the Drawings section of the specification, applicants state that the graph of Figure 11 shows a film of a *conventional* photomask blank (spec. pg. 16, l. 1-3). The term "conventional" suggests that the data

depicted in graph 11 is not inventive. Therefore a label of "Prior Art" is appropriate. The examiner maintains the objection as set forth above.

Claim Interpretations

5. The examiner notes that the specification mainly pertains to the use of a chromium thin film. However page 41, lines 9-16 of the specification indicates that the film can be composed of a material containing mainly a transition metal such as titanium, nickel, copper, molybdenum, tantalum or tungsten. The examiner has interpreted the minus sign in instant claim 31 to be an indication of tensile stress as opposed to a plus sign, which indicates a change in compressive stress (spec. pg. 5, l. 9-21).

6. The examiner notes that claims 32, 34, 36, 38, 40, 42, 45, 50, 52-44 and 57-65 refer to a vacuum chamber. It is the examiner's position that a sputtering apparatus inherently has a vacuum chamber. This position is supported by disclosure of Torus Sputter Sources by the Kurt J. Lesker Company (http://www.lesker.com/cfdocs/newweb/framesets/framesetdownloads.cfm), which discloses that sputtering is a deposition technique in which material is removed from a solid target by ion bombardment, and then deposited in atomic layers on a substrate. The source of ions is a low-pressure plasma created by electron bombardment of an inert gas contained in a vacuum chamber at 1 to 30 millitorr (pg. 2 lines 1-8).

7. The examiner further notes that independent claims 31-32 and 69 are written as product-by-process claims. More specifically, the claim recites method limitations that do not further define the material. Therefore, any method may be used to make the material. Consequently, the burden shifts to Applicant to provide evidence of an unobvious difference

between the claimed product and the prior art. Furthermore, "The Patent Office bears a lesser burden of proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature" than when a product is claimed in the conventional fashion. In re Fessmann, 180 USPQ 324,326 (CCPA 1974), see MPEP 2113.

8. The following rejections are based on the said interpretations.

Claim Rejections - 35 USC § 112-1st paragraph

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

10. Claims 32, 34, 36, 38, 40, 42, 45, 50, 53-55, 58-65, 67 and 69-70 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the formation of a thin film by a deposition rate, does not reasonably provide enablement for "the formation of a thin film conducted at a thin film deposition rate in a manner that a particle occurrence frequency dependent on the thin film deposition rate is restrained so that the production yield rate dependent on the particle occurrence frequency is within tolerance". The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. The examiner has failed to find support for the said limitation in the instant specification. The examiner has also failed to find a definition of tolerance as used in the said claims.

Claim Rejections - 35 USC § 112-2nd paragraph

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

12. Claims 32, 34, 36, 38, 40, 42, 45, 50, 53-55, 58-65, 67 and 69-70 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The examiner has failed to find a definition of "tolerance" as set forth in the said claims. The dictionary defines tolerance as the limit of error permitted in the graduation of measuring instruments or of any standardized product (Hackh's Chemical Dictionary 3rd edition). The examiner has interpreted the claim to be limited by the limit of error of the sputtering device. Clarification is requested.

Claim Rejections - 35 USC § 102

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

14. Claims 31-32, 43. 47, 49 and 68-69 are rejected under 35 U.S.C. 102(a) as being anticipated by Shinji et al. (JP 11-012730, machine translation) with Yang et al. (US 6358636 B1) cited to show inherent properties. Shinji teaches a process of forming an integrated circuit pattern of a thin chromium (Cr) film of low stress on a conductive substrate by using a He-Ar gaseous mixture of a specific composition as a sputter gas in a sputtering

method using Cr as a sputtering target. The said gas mixture contains 5-25 vol.% Ar gas and the balance He gas (i.e., 75-95 %) (abstract). When the amount of Ar is less than 5%, plasma is not stabilized and sputtering becomes difficult. When the amount of Ar exceeds 25%, the amount of supply of He incorporated is decreased and the stress controlling property becomes deteriorated (abstract). The examiner is of the position that this statement suggests that the correlation between the He contained in the atmosphere gas and the film stress is determined prior to introducing the gas into the vacuum chamber of the sputtering apparatus.

The taught invention gives a Cr thin film, which has low stress with sufficient adhesion with a ground (i.e., substrate) (p. 0010). Suitable substrates include a silicon wafer, glass and synthetic resin. Shinji exemplifies a process wherein a Cr film is sputtered onto a silicon substrate. Sputtering was performed at a spatter power of 800 W. The helium gas was introduced into 50 sccm and the argon was introduced at a flow rate of 5 sccm (10:1). A Cr film of 50 nm was formed. The said film changed from compressive stress to tensile stress by 4-6 mTorr, and it became about 0 stress by 5 mTorr (p. 0017-0020). While Shinji fails to exemplify the use of a transparent substrate, one of ordinary skill in the art could clearly envisage, from the teachings of Shinji, the use of a glass substrate, which is naturally transparent. It is the examiner's position that a Cr thin film would inherently posses a shading function as claimed by the instant application. The examiner is also of the position that a system having a Cr thin film sputtered onto a transparent substrate in an atmosphere containing He in the amount of 75-95 vol.% would inherently have a change in flatness (tensile stress) of -2μm or less.

Shinji teaches that the sputtering system used is a RF sputtering system made from ANELVA, SPF-530H (p. 0018). Yang teaches that conventional sputtering systems such as ANELVA (Japan) are double sided, in-line high-throughput machines having two interlocking systems for loading and unloading (c. 4, l. 20-30).

Shinji is silent on the issue of grain size. However, the examiner is of the position that when He is present as a mixed gas, the grain size of the formed Cr thin film would inherently be within the claimed range as defined by the instant specification on page 22, lines 12-22.

Response to Arguments

15. In regard to the 102(a) rejection over Shinji (JP 11-012730) applicants argue that the prior art neither teaches nor suggests a photomask blank having a flatness degree equal to -2μm or less. Moreover, the prior art fails to teach the claimed deposition rate as set forth in the specification for achieving such a flatness degree. As discussed above, Shinji teaches the formation of Cr thin film sputtered onto a transparent substrate in an atmosphere containing He in the amount of 75-95 vol.%. It is the examiner position that when He is present in the said amount, it would inherently have a change in flatness of equal to -2μm or less as defined by your specification on page 25, lines 9-22. Claim 31 is as written does not claim a deposition rate. See also paragraph 7 above.

The examiner maintains the rejection as set forth above.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. Claims 50-54, 60, 63, 67 and 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinji (JP 11-012730, machine translation) with Yang (US 6358636 B1) as applied to claims 31- 47, 49 and 69 above and in further view of Inoue et al. (US 6309515 B1). Shinji as discussed above teaches a process of forming a thin Cr film on a glass substrate. Shinji exemplifies a process wherein chromium is sputtering at a spatter power of 800 W. It would have been obvious to one of ordinary skill in the art to increase the sputtering power in order to increase the film yield, as it is well known and conventional in the art. This position is supported by teachings of Inoue et al. (US 6309515 B1), which shows in figure 20 that an increase in power causes an increase in yield percentage.

Shinji is silent on the deposition rate used to deposit the metal on the taught substrate. However, since there is a direct relationship between sputtering power, deposition rate and film yield (see figure 21 of Inoue), one of ordinary skill in the art would expect that an optimization of one parameter (i.e., film yield) would result in the optimization of another (sputtering power, deposition rate).

Response to Arguments

18. In regard to instant claim 50, the rejection of the claims over Shinji with Yang in view of Inoue, applicants argue that the prior art fails to teach and/or suggest "the formation of a thin film conducted at a thin film deposition rate in a manner that a particle occurrence frequency dependent on the thin film deposition rate is restrained so that the production yield rate dependent on the particle occurrence frequency is within tolerance", the deposition

rate of instant claim 51, and the specific requirements of instant claim 52. The examiner maintains the position that one of ordinary skill in the art would have been motivation to increase the sputtering power in order to increase the film yield, as it is well known and conventional in the art, as supported by figure 20 of Inoue. Further, one of ordinary skill in the art would expect that an optimization of one parameter (i.e., film yield) would result in the optimization of another (sputtering power, deposition rate). Applicants have provided no evidence that the optimization of film yield would not result in the optimization of deposition rate and sputtering power. There is also no evidence that the thin film formed by Shinju having a helium content of 75-95% would not inherently meet the limitations of the instant claims. The examiner maintains the position of record.

19. Applicants also argue that the acceptable limit of stress acting on the substrate of the claimed invention is completely different from the prior art. The claims as written do not require a substrate thickness. Both the claimed invention and the prior both pertain to a photomask blank formed from a thin film in the presence of helium.

The examiner maintains the rejection as set forth above.

Claim Rejections - 35 USC § 103

20. Claims 33-34, 41-42 and 55-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinji (JP 11-012730, machine translation) with Yang (US 6358636 B1) in view of Inoue et al. (US 6309515 B1) as applied to claims 31-32, 47, 49, 50-54, 60, 63, 67 and 69-70 above and in further view of Mitsui et al. (US 6087047 A). Shinji in view of Inoue teach all the limitations of the instant claims except it fails to teach the presence one or both of carbon or oxygen. Mitsui teaches that it is effective to introduce oxygen in the semi-

transparent film in order to obtain the desired semi-transparent film by controlling the optical absorption characteristic and the optical transmission characteristic in balance (c. 8, l. 56-62). One of ordinary skill in the art would have been motivated by the teachings of Mitsui to incorporate oxygen into the thin film of Shinji in order to control the optical absorption and optical transmission in balance.

Mitsui further teaches that nitrogen in the film controls the transmittance and is effective to mainly change the refractive index (c. 8, l. 54-55). One of ordinary skill in the art would have been motivated by the teachings of Mitsui to incorporate nitrogen into the thin film of Shinji in order to control the transmittance and refractive index.

Response to Arguments

21. The examiner maintains the rejection of Shinji with Yang in view of Inoue and Mitsui for the reasons discussed above in paragraphs 15 and 18-19 above.

Claim Rejections - 35 USC § 103

22. Claims 31-34, 41-42, 48-50, 53-57, 60, 64-66 and 69-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitsui et al. (US 6087047 A). Mitsui teaches a half-tone phase shift mask blank in which a semi-transparent film is formed on a transparent substrate. It is the examiner's position that a semi-transparent film meets the limitation of a film having a shading function as set forth in the instant claims. The semi-transparent film includes silicon and nickel and at least one selected from the group consisting of nitrogen, oxygen and hydrogen (abstract). Nitrogen in the film controls the transmittance and is effective to mainly change the refractive index (c. 8, l. 54-55). The oxygen is effective for controlling the transmittance. In particular, it is effective to introduce the oxygen in the semi-transparent

film in order to obtain the desired semi-transparent film by controlling the optical absorption characteristic and the optical transmission characteristic in balance (c. 8, l. 56-62). The nitrogen is added in order to avoid reduction of the refractive index due to the excess oxygen, which serves to improve the refractive index (c. 9, l. 10-13). Mitsui teaches that nickel in the film is effective to satisfy the basic requirement characteristics such as transmittance and the reflective index for the exposure wavelength by selecting and controlling film composition containing nickel and the film quality. Further, nickel in the film effectively improves the electrical characteristics, the optical characteristics and the chemical durability in the film itself or with the other metal or transition metal elements (c. 9, l. 23-c. 10, l. 7). Stress generated in the film can be controlled to the desired value by the use of the amorphous film structure (c. 10, l. 12-13). The depositing method of the semi-transparent film includes a variety of thin film forming methods such as sputtering deposition method, the vaporizing method, the chemical vapor deposition method, the ion beam deposition method and the electron beam vaporizing method. Among them, the sputtering deposition method, which uses as sputtering target and gas containing constituent element of the semi-transparent film, is most effective in regard to productivity, manufacturing yield and the stability of the mask material (c. 10, l. 47-57). It is possible to readily entrap the nitrogen, the oxygen and the hydrogen by using these gases themselves or mixing them and by mixing them with gases such as helium (He), argon (Ar) and xenon (Xe) (c. 11, l. 37-42). The phase shift mask can be obtained by using the above-mentioned phase shift mask blank and by forming the semi-transparent mask to be transferred into the wafer on the transparent substrate. In this event, the semi-transparent film on the blank is patterned by the use of the lithography method. As

such lithography method, a method, which is used in the general mask manufacturing process, may be applied such as dry etching (c. 11, l. 51-64). A dry etch process would selectively remove the film formed on the taught substrate. Mitsui teaches that the taught invention relates to a phase shift mask for use in exposing and transferring a fine pattern (c. 1, l. 5-9).

Mitsui exemplifies a third example wherein the sputter target was fabricated by mixing the silicon and nickel at the rate of about 3:1 by mol. The semi-transparent film was formed on a quartz substrate by the direct current sputter using a sputter gas mix of Ar, N_2, O_2 and H_2 at the rate of 20:74:1:5 by the flowing rate (c. 14, l. 48-c. 15, l. 60). Mitsui further exemplifies a sixth example wherein the sputter target was fabricated by mixing the silicon, the oxidation silicon, the nickel and tantalum with the rate of about 5:2:2:1 by mol. The semi-transparent film was formed on a quartz substrate by the direct current sputter using a sputter gas mix of Ar and N_2 at the rate of 4:6 by the flowing rate (c. 18, l. 22-c. 19, l. 27). The seventh example further teaches a sputter target fabricated by mixing silicon, the oxidation silicon, the nickel and tantalum with the rate of about 5:2:2:1 by mol and using a sputter gas mixture of Ar, N_2, and H_2 at the rate of 3:6:1 by the flowing rate (c. 19, l. 30-c. 20, l. 35). It is the examiner's position that nickel and tantalum both meet the limitations of a transition metal as set forth in the instant claims. The said examples were irradiated with ArF excimer laser having an oscillation wavelength of 193 and energy density of 1 mJ/cm^2 per unit pulse with 10^7 pulses. The formed fabricated film was etching by the use reactive ion etching (RIE).

Mitsui fails to exemplify a process wherein He gas is used. However, Mitsui does teach that Xe gas or He gas may be used instead of Ar. (c. 21, l. 6-11). One of ordinary skill in the art would have been motivated by the teachings of Mitsui to make thin film by the exemplified processes, particularly examples 3, 6 and 7, wherein the sputter gas contains He in the content of 20%, 40% and 30 % respectively. One of ordinary skill would have been motivated by the teachings of Mitsui to substitute the exemplified argon gas for helium gas and readily expect reasonably similar results.

Mitsui is silent on the issue of tensile stress or flatness degree. The examiner is of the position that a system having the same components of the taught invention would have a tensile stress of less than -2μm. Specifically, a system similar to examples 3, 6 and 7, which contain helium gas in the amount of 20, 40 and 30 % respectively, would readily possess a tensile stress less than -2μm. Furthermore, it would have been obvious to one of ordinary skill in the art to determine how the gas mixture would affect the formed film.

Response to Arguments

23. Applicants argue that because Mitsui fails to teach and/or suggest the deposition rate in described in the present specification it cannot inherently describe the recited flatness degree. One of ordinary skill in the art would have been motivated by the teachings of Mitsui to make thin film by the exemplified processes, particularly examples 3, 6 and 7, wherein the sputter gas contains He in the content of 20%, 40% and 30 % respectively. One of ordinary skill would have been motivated by the teachings of Mitsui to substitute the exemplified argon gas for helium gas and readily expect reasonably similar results. It is the examiner position that a system similar to examples 3, 6 and 7, which contain helium gas in

the amount of 20, 40 and 30 % respectively, would readily possess a tensile stress of -2μm or less as defined by your specification on page 25, lines 9-22. Claim 31 is as written does not claim a deposition rate. (See also paragraph 7 above). Furthermore, it would have been obvious to one or ordinary skill in the art to modify the deposition rate of Mitsui to obtain optimal results.

The examiner maintains the rejection as set forth above.

Allowable Subject Matter

24. Claims 35-40, 44-46, 58-59 and 61-62 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

25. The following is a statement of reasons for the indication of allowable subject matter: review of the prior art failed to teach and/or suggest a photomask blank having (1) a thin film which is a laminated film comprising a shading layer and an antireflective layer as set forth in instant claims 35-40, 58-59 and 61-62; and (2) a thin film having a nitride film formed between the transparent substrate and the thin film as in claims 44-46.

Conclusion

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yvette C. Thornton whose telephone number is 571-272-1336. The examiner can normally be reached on Monday-Thursday 8-6:30.

27. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F. Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

28. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-1300.

Yvette Clarke Thornton
Patent Examiner
Art Unit 1752

yct
January 7, 2004